Listing of Claims:

1.   (Currently Amended)   An image processing apparatus ~~for assuming a characteristic of a virtual image sensing optical system, and applying a blur effect corresponding to a preset in-focus state to a captured image,~~ comprising:

5   an image input unit for capturing image information including distance information to each portion of an object to be photographed;

a parameter input unit for inputting a parameter from which an effective aperture and focal length of ~~the~~ an assumed image

10   sensing optical system can be derived;

an in-focal ~~pint~~ point position designation unit for designating an in-focal ~~pint~~ point position of the assumed image sensing optical system;

a blur state calculation unit for calculating a blur state

15   from the distance information input by said image input unit, the in-focal ~~pint~~ point position designated by said in-focal ~~pint~~ point position designation unit, and the parameter input by said parameter input unit; and

an image processing unit for applying ~~the~~ a blur effect to

20   the image input by said image input unit in correspondence with the blur state calculated by said blur state calculation unit;

wherein the in-focal point position designated by said in-focal point position designation unit is determined using the

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distance information included in the image information, based on

25   a position which is designated by a user in an image

corresponding to the image information.

        Claims 2 and 3 (Canceled).

        4.   (Currently Amended) An image processing apparatus ~~for~~

~~assuming a characteristic of a virtual-image sensing optical~~

~~system, and applying a blur effect corresponding to an in-focus~~

~~state to a captured image,~~ comprising:

5   an image input unit for capturing image information

including distance information to each portion of an object to be

photographed;

        a parameter input unit for inputting a parameter from which

an effective aperture and focal length of ~~the~~ an assumed image

10   sensing optical system can be derived;

        an in-focal ~~pint~~ point position designation unit for

designating an in-focal ~~pint~~ point position of the assumed image

sensing optical system;

        a confusion circle calculation unit for calculating a

15   confusion circle from the distance information input by said

image input unit, the in-focal ~~pint~~ point position designated by

said in-focal ~~pint~~ point position designation unit, and the

parameter input by said parameter input unit;

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20   a blur state calculation unit for calculating a blur state

using a point spread function ~~(PSF)~~ within a range corresponding

to a size of the confusion circle calculated by said confusion

circle calculation unit; and

an image processing unit for applying ~~the~~ <u>a</u> blur effect to

the image input by said image input unit in correspondence with

25   the blur state calculated by said blur state calculation unit<u>;</u>

<u>wherein the in-focal point position designated by said in-</u>

<u>focal point position designation unit is determined using the</u>

<u>distance information included in the image information, based on</u>

<u>a position which is designated by a user in an image</u>

30   <u>corresponding to the image information</u>.

5.   (Currently Amended) An image processing method ~~of~~

~~assuming a characteristic of a virtual image sensing optical~~

~~system, and applying a blur effect corresponding to a preset~~

~~in-focus state to a captured image,~~ comprising ~~the steps of~~:

5   capturing image information including distance information

to each portion of an object to be photographed;

inputting a parameter capable of deriving an effective

aperture and focal length of ~~the~~ <u>an</u> assumed image sensing optical

system;

10   designating an in-focal ~~pint~~ <u>point</u> position of the assumed

image sensing optical system;

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calculating a blur state from the input distance

information, the designated in-focal ~~pint~~ point position, and the

input parameter; and

15   applying ~~the~~ a blur effect to the input image in

correspondence with the calculated blur state;

wherein the in-focal point position designated by said in-

focal point position designation unit is determined using the

distance information included in the image information, based on

20   a position which is designated by a user in an image

corresponding to the image information.

6.   (Currently Amended)   An image processing method ~~of~~

~~assuming a characteristic of a virtual image sensing optical~~

~~system, and applying a blur effect corresponding to an in-focus~~

~~state to a captured image,~~ comprising ~~the steps of~~:

5   capturing image information including distance information

to each portion of an object to be photographed;

inputting a parameter from which an effective aperture and

focal length of ~~the~~ an assumed image sensing optical system can

be derived;

10   designating an in-focal ~~pint~~ point position of the assumed

image sensing optical system;

calculating a confusion circle from the input distance

information, the designated in-focal ~~pint~~ point position, and the

input parameter;

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15   calculating a blur state using a point spread function ~~(PSF)~~

within a range corresponding to a size of the calculated

confusion circle; and

applying ~~the~~ <u>a</u> blur effect to the input image in

correspondence with the calculated blur state<u>;</u>

20   <u>wherein the in-focal point position designated by said in-</u>

<u>focal point position designation unit is determined using the</u>

<u>distance information included in the image information, based on</u>

<u>a position in an image which is designated by a user</u>.

Claim 7 (Canceled).

8.   (Currently Amended) ~~An article of manufacture~~

~~comprising: a~~ <u>A</u> computer-readable storage medium having

computer-readable program code means stored <u>thereon</u> ~~to assume a~~

~~characteristic of a virtual image sensing optical system and~~

5   ~~apply a blur effect corresponding to a preset in-focus state to a~~

~~captured image in an image processing apparatus~~, said

computer-readable program code means comprising:

first computer-readable program means for providing a

computer with a function of capturing image information including

10   distance information to each portion of an object to be

photographed;

second computer-readable program means for providing the

computer with a function of inputting a parameter from which an

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effective aperture and focal length of ~~the~~ an assumed image

15   sensing optical system can be derived;

third computer-readable program means for providing the

computer with a function of designating an in-focal ~~pint~~ point

position of the assumed image sensing optical system;

fourth computer-readable program means for providing the

20   computer with a function of calculating a blur state from the

input distance information, the designated in-focal ~~pint~~ point

position, and the input parameter; and

fifth computer-readable program means for providing the

computer with a function of applying ~~the~~ a blur effect to the

25   input image in correspondence with the calculated blur state;

wherein the in-focal point position designated by said in-

focal point position designation unit is determined using the

distance information included in the image information, based on

a position which is designated by a user in an image

30   corresponding to the image information.

9.   (Currently Amended) ~~An article of manufacture~~
~~comprising: a~~ A computer-readable storage medium having

computer-readable program code means stored thereon ~~to assume a~~

~~characteristic of a virtual image sensing optical system and~~

5   ~~apply a blur effect corresponding to an in-focus state to a~~

~~captured image in an image processing apparatus~~, said

computer-readable program code means comprising:

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first computer-readable program means for providing a

computer with a function of capturing image information including

10   distance information to each portion of an object to be

photographed;

second computer-readable program means for providing the

computer with a function of inputting a parameter from which an

effective aperture and focal length of ~~the~~ an assumed image

15   sensing optical system can be derived;

third computer-readable program means for providing the

computer with a function of designating an in-focal ~~pint~~ point

position of the assumed image sensing optical system;

fourth computer-readable program means for providing the

20   computer with a function of calculating a confusion circle from

the input distance information, the designated in-focal ~~pint~~

point position, and the input parameter;

fifth computer-readable program means for providing the

computer with a function of calculating a blur state using a

25   point spread function ~~(PSF)~~ within a range corresponding to a

size of the calculated confusion circle; and

sixth computer-readable program means for providing the

computer with a function of applying ~~the~~ a blur effect to the

input image in correspondence with the calculated blur state;

30   wherein the in-focal point position designated by said in-

focal point position designation unit is determined using the

distance information included in the image information, based on

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<u>a position which is designated by a user in an image</u>

<u>corresponding to the image information</u>.

Claim 10 (Canceled).

11.   (Currently Amended)   An image processing apparatus
comprising:

means for inputting image data including depth information;

means for setting a parameter for expressing a lens

5   characteristic;

means for setting ~~any~~ one of a focal length, F-number, field
angle, and effective aperture;

means for setting a distance ~~for adjusting a~~ <u>in</u> focus;

means for calculating expression of an image texture

10   including a blur from ~~the~~ virtual camera setting values and the
depth information of the image; and

means for storing a calculation result in a memory

<u>wherein an in-focal point position is determined using the</u>

<u>depth information included in the image data based on a position</u>

15   <u>designated by a user in an image corresponding to the image data</u>.

12.   (Original)   An apparatus according to claim 11, further
comprising means for inputting an image having depth information
in units of pixels of a two-dimensional image.

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13. (Currently Amended)   An apparatus according to

claim 11, wherein a blur function is a point spread function

~~(PSF)~~ calculated in units of pixels from the focal length of a

lens, the F-number or aperture, ~~the~~ an object distance, and the

5   depth information of the image data.

14. (Currently Amended)   An apparatus according to

claim 11, wherein a blur function has a variable function shape,

and is one of a concave function ~~or~~ and a convex function

determined by a focal ~~pint~~ point position and an object distance

to be calculated.

15. (Currently Amended)   An apparatus according to

claim 11, wherein ~~a user can freely change, with a volume,~~ the

F-number and a focal ~~pint~~ point position designated by the user

are adapted to be changeable by the user with a sliding switch,

5   and wherein a calculation result using a thumbnail image obtained

by thinning out an input image is displayed to interactively

obtain a confirmable parameter setting.

Claim 16 (Canceled).

17. (Currently Amended)   An apparatus according to

claim 11, wherein ~~a user freely changes~~ the F-number ~~with a~~

~~volume~~ is adapted to be changeable by the user with a sliding

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switch while ~~designating~~ the user designates a focal ~~pint~~ point

5   position on a designated window, and wherein a calculation result

using a thumbnail image obtained by thinning out an input image

is displayed to interactively obtain a parameter setting ~~capable~~

~~of confirming~~ which is adapted to confirm designation of the

focal ~~pint~~ point position and the F-number.

18.   (Currently Amended)   An apparatus according to

claim 11, wherein ~~a user can change~~ a zoom ratio is adapted to be

changed by the user by changing an f-number.

19.   (Currently Amended)   An apparatus according to

claim 11, wherein a central point of a zoom and a position to get

into focus are set in setting a zoom ratio, and wherein central

coordinates of the zoom and depth information of the central

5   point are used to one of calculate a blur state and an

enlargement on a window and ~~a blur state or~~ to interactively

determine a parameter.

20.   (Original)   An apparatus according to claim 19, wherein

an outer frame in an area to be enlarged and displayed without

changing a display ratio is displayed in setting the zoom ratio.

21.   (Currently Amended)   An apparatus according to

claim 11, wherein a window is enlarged based on central

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coordinates of a zoom designated by a user, a focal ~~pint~~ point

position on the window is designated to determine the focal ~~pint~~

5   point position, the F-number is freely changed with a ~~volume~~

sliding switch, and a calculation result using a thumbnail image

obtained by thinning out an input image is displayed to

interactively obtain a parameter setting ~~capable of confirming~~

which is adapted to confirm designation of a central position of

10   the field angle, a zoom ratio, and the F-number.

22.   (Original) An apparatus according to claim 11, wherein

a blur state is expressed using influence of coma which changes

depending on a distance and azimuth from a center of an image.

23.   (Original) An apparatus according to claim 11, wherein

an asymmetrical point spread function is calculated for coma

using a blur function obtained by shifting a central position of

a radius of a confusion circle in accordance with a distance from

5   a central position of an image.

Claim 24 (Canceled).

25.   (Currently Amended) An apparatus according to

claim 11, wherein a range d-Δ from $\underline{d}$ on a point spread function

for a radius (d) of a symmetrical confusion circle is set as a

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chromatic aberration influence range, and <u>one of</u> red aberration

5   ~~or~~ <u>and</u> blue aberration is applied.

       Claim 26 (Canceled).

       27.   (Currently Amended)   An apparatus according to

claim 11, wherein <u>one of</u> a blue range ~~or~~ <u>and a</u> red range of a

color characteristic at not less than a given distance is <u>one of</u>

emphasized ~~or~~ <u>and</u> decreased.

       28.   (Currently Amended)   An apparatus according to

claim 11, further comprising means for inputting, as a set of

units, depth information and image information in units of <u>one of</u>

pixels ~~or~~ <u>and</u> areas for each object.

       29.   (Currently Amended)   An apparatus according to

claim 11, wherein an input image ~~is~~ <u>comprises</u> a set of objects

having a predetermined distance in units of ~~not pixels but~~ sets

of objects <u>and not in units of pixels</u>.

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